IN THE UNITED STATES PATENT & TRADEMARK OFFICE

MULTI-PURPOSE CONSTRUCTION ASSEMBLY AND METHOD

CROSS-REFERENCES TO RELATED APPLICATIONS

None.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to light-gauge steel construction, and more particularly to a new construction assembly and method which is intended for the construction of single and multi-story buildings without structural steel. The present invention provides the easiest and most economic means to construct single and multi-story buildings from light gauge steel which comply with applicable building codes and is resistant to environmental forces. Furthermore, the construction assembly and method can form wall assemblies with and without apertures for windows or doors, floor assemblies, and truss assemblies.

2. Description of Prior Art

In recent years, the use of metal studs has gained acceptance, and is mandated for use in multi-story buildings, i.e., commercial buildings, such as office buildings and hospitals. It has been found that metal studs can be advantageously employed, since a suitable metal, such as galvanized steel, is stronger than wood, will not rot, is not subject to damage by pests such as

termites, remains resistant to fire, and is economically feasible. Historically, construction of such multi-story buildings was done piece by piece, i.e., stud by stud, thereby requiring substantial time, labor and money to construct a multi-story building.

Conventional steel frame buildings are constructed using thick gauge steel to form the structural skeleton of the building. However considerable difficulties arise in using thick gauge steel for building frames. The thick gauge steel is difficult to cut and form. Often, the heat generated by cutting destroys the galvanized coating on the steel. An added difficulty arises in joining the structural members once formed to make up a building frame. Owing to the rigid nature of the thick gauge steel, these structural members cannot be easily deformed to fit one within another and must undergo crimping or other special forming operations to ensure the proper mating between structural steel members.

A difficulty with conventional building structures is that assembly of the various elements requires skilled labor. In timber structures, the roof trusses are often constructed by assembling timber pieces on-site because the heavy timber would be difficult to manage and lift an assembled or partially assembled form. The difficulty of assembling trusses on-site is that all the roof trusses must be assembled to define a plane for the intended roof surface and thus the upper edges of all the roof trusses must align. Thus, considerable skilled labor is required to form a planar roof using a conventional truss system.

Over the course of time, prefabricated buildings came into existence whereby manufacturers would assemble large portions of a building off-site for complete construction at the building location. Although partially pre-fabricated, complete construction remained time consuming and costly because the pre-fabricated pieces would often times not properly fit together thereby requiring deformation of the adjacent pieces to join the pieces. In addition, structural steel would still be required to form the structural foundation of the building. Generally, pre-fabricated structures were not intended to endure extreme environmental forces such as seismic events or wind sway caused by hurricane winds, unless specially engineered to do so..

Generally, both multi-story and single story buildings were constructed piece by piece or

using pre-fabricated construction units consisting of metal studs, metal headers, metal anchors, fasteners, and wallboard. These pieces alone do not support the construction of a multi-story building let alone an edifice which could withstand extreme environmental forces. The invention disclosed herein presents a multi-purpose assembly to form pre-fabricated walls, pre-fabricated floors and pre-fabricated trusses for the construction of a multi-story building which can be assembled easily and cost effectively, without the need of structural steel while still withstanding environmental forces such as gravity from floor loads, seismic forces from earthquakes, and wind sway from hurricane-type winds.

Metal studs are typically formed of sheet metal bent to encompass a cross sectional area having nominal dimensions of two inches by four inches. To conform to architectural plans and building code requirements, metal studs are formed of sheet metal bent into generally "c"-shaped cross-section in which a relatively broad central base is flanked by a pair of narrower sides that are bent at right angles to the base. The base typically has a uniform ranging from 1⅝ to 16 inches which is commonly referred to as the "web." The sides of the "c"-shaped stud typically extends a distance of 1 to 3 from the base which are commonly referred to as "flanges." To enhance structural rigidity the flanges of the stud, the flanges are normally bend over into a plane parallel to and spaced from the plane of the web. These turned over edges of the sides thereby form marginal lips which are typically one quarter to one half inch in width. Conventionally, the metal studs are erected with the webs oriented on the same side in the same direction.

Metal headers are typically formed of sheet metal bent into generally "u"-shaped cross-section in which a relatively broad central base is flanked by a pair of narrower perpendicular flanges extending downward from the base. The base typically has a uniform nominal width of either four inches or 3⅝ inches which is commonly referred to as the "web." The flanges of the "u"-shaped stud typically extends a nominal distance of two inches from the base. Each stud is attached to the header with a self tapping screw or other fastening means.

To complete a common construction assembly, sheathing manufactured from gypsum or plywood is attached to the outside of the studs. However, this common assembly is unable to

withstand extreme floor loads, wind sway or seismic tremors. If installed in a multi-story building the sheathing would crack and break as a result of being locked in place with a common construction assembly.

Recently, to overcome the locking of the sheathing, more specifically gypsum wallboard, the header and the means to attach the stud have been modified. This modification is reflected in U.S. Patent No. 5,127, 203, claim 5; and U.S. Patent No. 5, 913,788. U.S. Patent Nos. 5,127,203, and 5,127,760 disclose a header possessing a multiplicity of vertical slots along the longitudinal axis the flanges the permit the studs and wallboard attached thereto to deflect vertically as a result of seismic movement, and natural expansion and contraction of buildings. U.S. Patent No. 5,913,788 improved upon the wall assembly by the insertion of a metal stand-off washer between the self-tapping screw and the flange of the header to prevent locking the stud within the slotted metal header. U.S. Patent No. 5,913,788 provided for horizontal movement in response to environmental forces with the addition of a horizontal slot in the web of the slotted u-shaped channel. In addition, U.S. Patent No. 5,913,788 improved upon the method of fire-proofing used with respect to headers that deflect with the inclusion of pop-up tabs built into the header to hold the fire-safing material inserted into the flutes of the corrugated metal decking generally installed as part of the roof structure above the wall assembly. Despite these improvements, the wall assemblies disclosed by U.S. Patent No. 5,913,788; No. 5,127,760; and No. 5,127,203 did not provide a means for reinforcing the assemblies against sheer forces and perpendicular forces such as wind. Furthermore, the assembly disclosed by each of the foregoing patents is only useable as an interior wall assembly. The foregoing assemblies cannot withstand environmental forces of wind in order to be used as an outside wall structure, or withstand the application of weight in a horizontal setting as a floor. Consequently, a new assembly and method became necessary to endure these environmental forces while as obviating the need for costly structural steel.

Historically, vertical metal studs are braced or linked transversely to provide enhanced structural rigidity. The first method of bracing was known as "Black Iron." "Black Iron" comprises a metal "u"-shaped channel which is run through the parallel apertures of the parallel

studs to reinforce the parallel studs. Additional examples of such braces are disclosed in United States Patent Nos.: 6,260,318; 5,189,857; 4,791,766; 4,658,556; and 1,867,449. However, the prior art does provide the strength necessary for such assemblies to meet or exceed building code requirements for use as either a floor assembly or exterior wall assembly. The Florida Building Code requires that floor assemblies shall withstand a maximum of 150 pounds per square foot of live load in armories and drill room, and 100 pounds per square foot of live load in residential, office buildings, and manufacturing facilities. *Florida Building Code § 1604 (2001).* The Florida Building Code further requires that wall assemblies withstand a minimum of 10 pounds per square foot. *Florida Building Code § 1606.1.2 (2001).*

The claimed invention discloses a construction assembly which may be used to form pre-fabricated floors, pre-fabricated exterior and interior walls which also serve as structural support for a multi-story edifice, and pre-fabricated trusses for the construction of roofs and ceilings. The use such pre-fabricated building assemblies allows property owners and contractors to construct multi-story buildings with less time, labor and cost, while still complying with applicable building and safety codes.

Moreover, the claimed assemblies avoid the cost of purchasing and installing structural steel to form the structural framework of a multi-story building. The unique bracing system incorporated into each assembly provides enough strength and integrity that the assembly can withstand 300 pounds per square foot of load.

The claimed assembly incorporates a means for fire stopping in accordance with the BOCA National Building Code and the anticipated International Building Code. The BOCA Code defines "draft stopping" as "building materials installed to prevent the movement of air, smoke, gases, and flame to other areas of the building through large concealed passages." See BOCA §7.02.0 (1999). *See also* International Building Code §702.1 (1998).

The claimed invention also incorporates a means for the attachment of handrails and grab bars in accordance with American With Disabilities Act code requirements when the assembly as used as a wall structure.. The transverse brace between parallel studs in the claimed invention permits the anchoring of hand rail and grab bars which can with stand 250 pounds of

point load pressure in accordance with the Americans with Disabilities Act. See *Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities*, 56 *Federal Register* 35408 (July 26, 1991).

SUMMARY OF THE INVENTION

The invention disclosed by this patent describes a novel construction assembly and method which may be interchangeably used as pre-fabricated floors, interior walls, exterior walls, and trusses in single and multi-story buildings. It is accordingly, an object of the invention to provide an assembly which meets or exceeds all building codes for wall, floor and truss assemblies. It is also an object of this invention to eliminate the use of structural steel in the construction of multi-story buildings. It is further an object of this invention to provide a construction assembly which can withstand environmental forces due to natural building expansion and contraction, seismic movements, wind sway from hurricane type winds, and absorb loads in excess of 300 pounds per square foot. It is an additional object of this invention to provide an assembly which is simple and efficient to install, and cost-effective for property owners and contractors alike. Another object of this invention is to readily absorb the errors of laborers during construction of a building based upon the ability the invention to expand and contract thereby allowing the assemblies to be installed without any gaps, fudging or cutting when interconnecting the assemblies to each other to form a complete building.

The claimed invention comprises several embodiments including but not limited to (a) pre-fabricated wall and floor assemblies with apertures for windows and doors; (b) pre-fabricated wall and floor assemblies without apertures for creating floors and walls without windows or doors; and (c) truss assemblies. The assemblies claimed herein are constructed from parallel standard metal studs. The first end of the parallel metal studs are slideably fastened to an expansion-contraction means. The expansion-contraction means comprises a "u"-shaped channel with generally parallel flanges depending from a web and parallel slots incorporated into said flanges. The opposite end of the stud is either slideably attached to a second expansion-contraction means, or fixedly attached to anchor means which is fixedly attached to

the floor below. To further absorb installation inaccuracies, as well as permit the building to expand and contract, at least one expansion-contraction means is slideably attached parallel to either the first or the last stud in the assembly. To provide rigidity to the assembly, at least one bridging, bracing and fire-blocking means is attached transversely between each parallel stud in the assembly. To complete the assembly, sheathing is installed on the anterior portion and posterior portion of the studs with a gap between the top of the sheathing and the ceiling to permit the sheathing to deflect without breaking or cracking the sheathing.

The claimed assembly may easily be modified to permit the installation of doors and windows when the assembly is used as a wall assembly. The simple modification requires the removal of a portion of a parallel stud within the assembly to create the door or window opening. The remaining portion of the severed stud left in the window or door opening is preferably secured between the remaining adjacent parallel studs with the installation of a bridging, bracing and fire-blocking means between the adjoining parallel studs to insure structural integrity of the assembly despite the integration of an aperture.

These together with other objects of the invention, along with various features of novelty which characterize the invention, are pointed out with particularity in the claims annexed to and forming part of this disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be made to the accompanying drawings and descriptive matter in which there is illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will be more readily apparent when considered in relation to the preferred embodiments of the invention as set forth in the specification and shown in the drawings. Referring now to the drawings which illustrate the invention as follows:

FIG 1 is perspective view of the construction assembly for use as either a wall or a floor.

FIG 2 is an exploded view of the construction assembly for use as either a wall or a floor.

FIG 2 A is a cross-sectional view of the bridging, bracing and fire-blocking means between the parallel vertical studs.

FIG. 3 is a perspective view of the construction assembly incorporating both a vertical and horizontal expansion-contraction joint.

FIG. 4 is a perspective view of the construction assembly incorporating horizontal expansion-contraction joints along the top end and bottom end of the studs.

FIG. 5 is perspective view of the construction assembly incorporating horizontal construction joints along the top and bottom of the studs and vertically attached to the terminal studs of the assembly.

FIG. 6 is a perspective view of the construction assembly for use as a wall incorporating a door opening.

FIG. 7 is a perspective view of the construction assembly for use as a wall incorporating a window opening.

FIG. 8 is a perspective view of the construction assembly formed as a truss with the expansion-contraction joint opposite the hypotenuse

FIG. 9 is a perspective view of the construction assembly formed as a truss possessing the expansion-contraction joint attached to the longest vertical stud.

FIG. 10 is a perspective view of the construction assembly formed as a truss the expansion-contraction joint attached parallel to the longest vertical stud and opposite the hypotenuse.

Reference Numbers	
10	Construction Assembly
15	Stud
16	First Terminal End of Stud
17	Second Terminal End of Stud
18	First Terminal Stud
19	Second Terminal Stud

20	Expansion-Contraction Means
30	Bridging, bracing and fire-blocking Means
32	Anchoring Means
35	Washer
40	Fastener Means
45	Sheathing

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and particularly to FIGS. 1 and 2, which depicts the construction assembly embodiment for use as either a wall or a floor assembly. The preferred embodiment incorporates a plurality parallel studs (15) which are preferably spaced apart 18 inches on center. The first terminal end of the studs (18) are fastened to a expansion-contraction means (20). It is preferred that the expansion-contraction means comprises a slotted u-shaped channel as described in U.S. Patent No. 5,127,203 claim 5 which is incorporated herein by reference. The second terminal end of the studs (19) are fastened to an anchoring means (32) or a second expansion-contraction means. The anchoring means comprises a "u"-shaped channel consisting of a horizontal web wide enough to accommodate the width a stud (15), and vertical flanges rising from the web at least two inches tall. It is preferred the first terminal end (16) and the second terminal end (17) of the studs (15) are secured respectively by a expansion-contraction means (20). The parallel studs (15) are slideably attached to the expansion-contraction means (20) using a fastener means (40). It is preferred that fastening means (40) is a self-tapping screw or other like fastener. To insure that the stud (15) deflects within the expansion-contraction means, it is recommended that a washer (35) is placed between the fastener (40) and the expansion-contraction means (20). It is preferred that the washer (35) is a stand-off washer as described in U.S. Patent No. 5,467, 566 which is incorporated herein by reference. If an anchor means comprising "u"-shaped channel is used to secure the second terminal end (17) of the parallel studs (15), the studs are fixedly attached to the anchoring means (32) using the fastening means (40).

To accommodate construction error, i.e., avoiding gaps between assemblies or cutting of the assemblies when the assemblies are interconnected to construct a building, it is preferred that at least one expansion-contraction means (20) is slideably fastened to the first terminal stud (18) of the construction assembly. It is preferred the expansion-contraction means comprises a slotted track as disclosed in U.S. Patent No. 5,127,203, which is incorporated herein by reference. The expansion-contraction means is attached to the terminal stud with self-tapping screws. It is preferred that a washer (35) is inserted between the fastener and the slotted track used as the expansion-contraction means. It is preferred that the washer (35) is a stand-off washer. To provide greater flexibility for the absorption of construction errors, a second expansion-contraction means (20) may be attached to the second terminal stud (19) of the construction assembly.

To provide structural support to the construction assembly, a plurality of bridging, bracing and fire-blocking means (30) are installed transversely between each parallel stud (15). It is preferred that the bridging, bracing and fire-blocking means (30) are installed between each parallel stud 6 to 12 inches on center apart from each other. The preferred bridging, bracing and fire-blocking means is a unitary bridging, backing and fire stop device described in U.S. Patent No. 6,260,318 which is incorporated herein by reference. However, preferred bridging, bracing and fire-blocking means described in U.S. Patent No. 6,260,318 is modified by reversing the second flange in an upward direction in order to permit the complementary installation of two of the unitary bridging, backing and fire stop devices between the parallel stud (15) to form a box structure. The box structure formed by the complementary installation of the preferred bridging means between the parallel studs (15) may be used as a conduit for running of utility lines through the construction assembly provided the box structure is aligned with the aperture generally formed in standard studs.

The method of constructing this new construction assembly is quite simple which supports the objective of cost-effectiveness. First, the studs (15) are laid parallel to each other with the "c"-shape of each stud facing the same direction. Second, the first terminal end (17) of the parallel studs (16) are inserted into the expansion-contraction means (20). Third, the studs

are slideably fastened (40) to the expansion-contraction means (20) through the apertures in the expansion-contraction means (20) with the fastener means (40) first passing through a washer (35). Fourth, the second terminal end of the stud (19) is inserted into the anchoring means (32). Fifth, the second terminal end of the stud is fastened to the anchoring means (32) using the fastener means (40). If the second terminal end of the stud is fastened to a expansion-contraction means (20), it is preferred that the fastening means is first inserted through the aperture of a stand-off washing (35) before securing the second terminal end of the stud (17) to the expansion-contraction means (20) to slideably connect the stud (15) and the expansion-contraction means. Sixth, the bridging, bracing and fire-blocking means (30) is inserted between each parallel stud (15). Seventh, the bridging, bracing and fire-blocking means (30) is fixedly attached between the parallel studs (15). Eighth, a first expansion-contraction joint (20) is slideably attached to the first terminal (18) stud using said fastening means (40) inserted through said washer (35). Ninth, if desired, a second expansion contraction joint (20) is slideably attached parallel to the second terminal stud (19) using said fastening means (40) inserted through said washer (35). Last, sheathing (45) is fixedly attached to the studs (15) so as not to impair expansion-contraction of the studs and sheathing in relation to the expansion-contraction means to complete the construction assembly (10). If the assembly is intended to be used as an interior wall, then gypsum wallboard is applied to the opposite sides of the assembly. If the assembly is to be used as an exterior wall then metal sheathing, wood paneling or glass is applied to the side which will form the exterior of the building, and gypsum wallboard is applied to the side which will form the interior wall of the building. If the assembly is intended to be used as a floor assembly, then plywood is attached to the opposite faces of the assembly to complete the assembly for use as a floor assembly.

Referring to FIG. 3, which depicts the construction assembly as a wall assembly incorporating a window opening. The preferred structure and method of construction discussed with respect to FIGS 1 and 2 above remains the same, with the addition the method to incorporate a window opening without defeating the integrity of the entire construction assembly. The window opening in the wall assembly is created by cutting out a section of at

least one of the parallel studs (15) to form the window opening. The terminal ends of the severed stud are capped by the bridging, bracing and fire-blocking means (30) or a "u"-shaped metal channel thereby forming a generally smooth square or rectangular opening for the installation of a window and frame.

Referring to FIG. 4, which depicts the construction assembly as a wall assembly incorporating a door opening. The preferred structure and method of assembly discussed with respect to FIGS 1 and 2 above remains the same, with the addition of the method to form the door opening which is created by removing a terminal length of at least one of the parallel studs to form the door opening. The remaining portion of the severed the stud is capped by either the bridging, bracing and fire-blocking means or a metal "u"-shaped channel attached between the remaining parallel studs which form the door opening. Thereafter, the door and its frame may be attached within the opening of the construction assembly.

Referring to FIG. 5, which depicts the construction assembly used as a truss assembly. In lieu of using parallel studs of equal length, parallel studs of increasing or decreasing length are used to form the hypotenuse of the triangular truss. The terminal ends of the stud which form the hypotenuse of the truss are fastened to an anchor means. It is preferred the anchor means comprises a "u"-shaped channel possessing a central web which is wide enough to accommodate the studs, and perpendicular flanges extending downward from the web at least two inches in length. The terminal ends of the studs opposite the hypotenuse are preferably attached to a expansion-contraction means (20). To provide the truss assembly with the greatest ability to absorb workmanship errors during the construction of a building, i.e., avoid gaps between construction assemblies, it is preferred the terminal stud forming the right angle of the triangle truss is slideably attached to an expansion-contraction means (20). It is preferred that self tapping screws are used as fasteners to secure the studs to the expansion-contraction means and anchor means. To insure that the stud deflects within the expansion-contraction means, it is recommended that a washer (35) is placed between the fastener (40) and the expansion-contraction means (20). It is preferred that the washer (35) is a stand-off washer as described in U.S. Patent No. 5,467, 566 which is incorporated herein by reference.

To provide structural support to the truss assembly, at least one bridging, bracing and fire-blocking means (30) is installed transversely between each parallel stud. The preferred bridging, bracing and fire-blocking means is a unitary bridging, backing and fire stop device described in U.S. Patent No. 6,260,318 which is incorporated herein by reference. However, the preferred bridging, bracing and fire-blocking means described in U.S. Patent No. 6,260,318 is modified by reversing the second flange in an upward direction to permit the complementary installation of two of the unitary bridging, backing and fire stop devices between the parallel stud to form a box structure. The box structure formed by the complementary installation of the preferred bridging means between the parallel studs (15) may be used as a conduit for running of utility lines through the construction assembly provided the box structure is aligned with the aperture generally formed in standard studs.

The method of construction for the truss assembly is same as for the wall and floor assembly discussed in relation to FIGS. 1 and 2.

It is preferred that the foregoing embodiments are constructed from galvanized steel, no less than sixteen gauge.

Having completed a detailed disclosure of the preferred embodiments of my invention, so that those skilled in the art may practice same, I contemplate variations may be made without departing from the essence of the invention claimed herein.